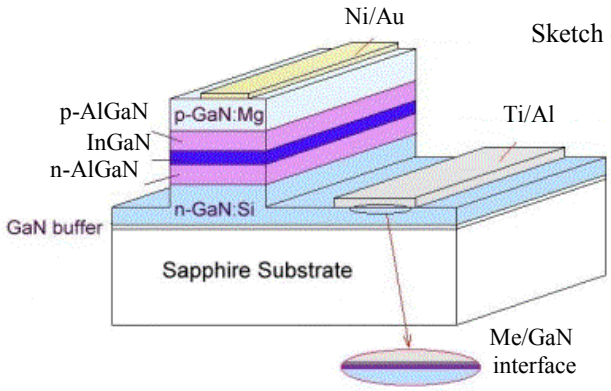
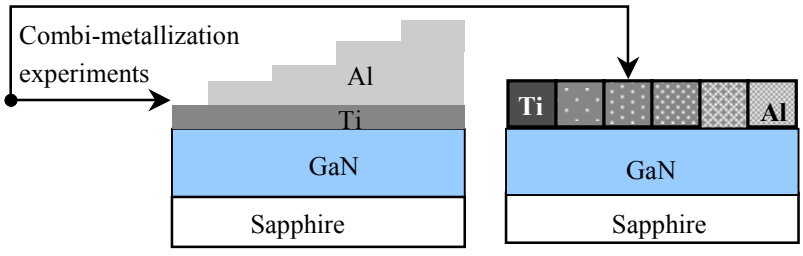
Metallization of GaN semiconductors

- Critical Issues
  - Gallium nitride based wide band-gap semiconductors find increasing applications in optical (blue LED's, lasers, detectors) and microelectronic (high-temperature, high-power, and high-frequency transistors) devices. However, the performance of GaN-based devices is limited by several materials and engineering problems, including the difficulty in making low-resistance, thermally stable metal contacts, especially to p-type GaN and AlGaN alloys.
- Research Strategy:
  - The approach is to: 1) better understand and quantify the relationship between the resistance of metal contacts to GaN and the fundamental compositional, microstructural and electronic properties of the metal/semiconductor interface and the near/interface GaN layer. The choice of layer composition sequence in the arrays will be guided by thermodynamic and kinetic modeling of selected metal/GaN systems.
- Research highlights:
  - Current research focuses on library design for contacts to n-GaN, including the optimization of contact resistivity as a function of metallization with variations of: i) semiconductor properties (doping levels, surface preparation); ii) metallization scheme (Ti/Al layer sequence, metal layer thickness and alloy composition); iii) processing schedule (annealing temperature, time, and ambient gas) .Working with the NIST Chemical Sciences and Technology Laboratory, we will develop methods to identify library elements with promising properties.



Sketch of the GaN-based LED



Ti/Al array of *layered* metallization (side view, schematic)

Array of codeposited Ti/Al grading metallization

For more information ...

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